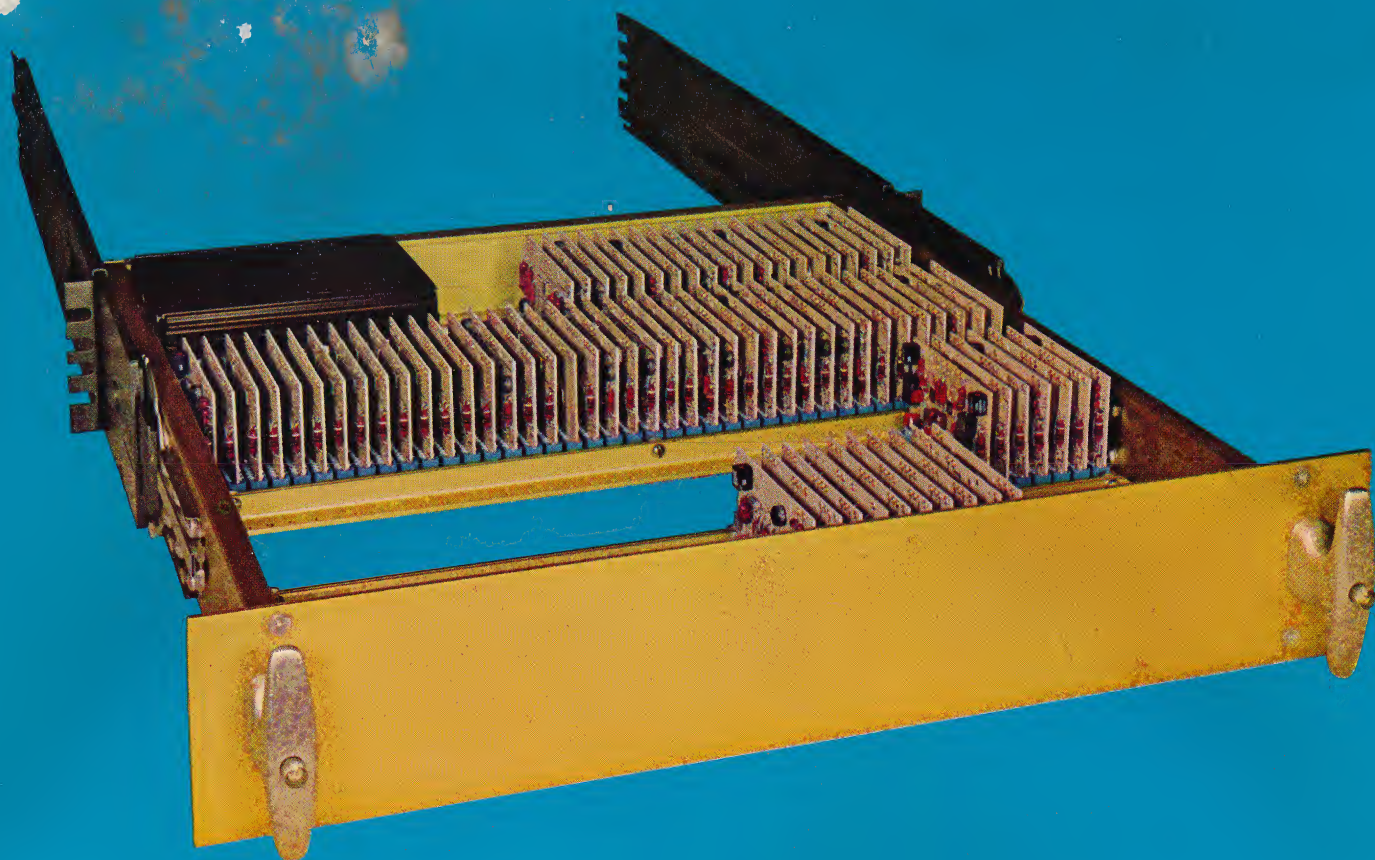




MICROSYSTEMS DTL
COMPONENTS

Integrated Circuit Cards

FEATURES

- Reliability - .0008% / 1000hrs.
- Complete Hardware Service
- DTL Threshold NAND Logic
- Full Temperature Range
- Simplified Design Rules
- High Noise Immunity
- 10:1 Size Reduction
- Single Power Supply
- Low Systems Cost
- 10 MC Operation

MICROSYSTEMS COMPONENTS is a service company, devoted to the manufacture of Integrated Circuit hardware for the systems user. Application of M/C products saves research time and cost of developing systems, by eliminating hardware design time and reducing documentation expenses. M/C provides a complete systems hardware service that allows standardization and simplification of design checkout and maintenance. Compatible analog elements are available for system expansion. All products and services below are covered by rigid quality control procedures to afford the user the performance and reliability advantages inherent with I. C.'s.

- | | |
|--------------------------------|---------------------------------|
| ● SYSTEM LOGIC BUILDING BLOCKS | ● SYSTEM FUNCTIONAL BLOCKS |
| ● A/D AND D/A CONVERTORS | ● ANALOG AND INTERFACE ELEMENTS |
| ● POWER SUPPLIES | ● PACKAGING AND CONNECTORS |
| ● TECHNICAL ASSISTANCE | ● DESIGN AND DOCUMENTATION AIDS |
| ● COMPLETE SUBSYSTEMS | ● CUSTOM PACKAGING |

M/C also provides fast, low cost service on your special requirements....new cards are typically available in three weeks with complete documentation and test procedures. Standard products are supplied from stock to two weeks. M/C drawers and card files wired per customer-furnished wire list and ready to install in your system, can be supplied in three weeks.

M/C's Engineering Staff is fully capable of developing complete subsystems and special test equipment....full documentation is furnished.

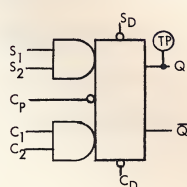
GENERAL DESCRIPTION

M/C Logic Cards utilize silicon DTL monolithic integrated circuits in the 14 lead flat-pack configuration. Basic gates are Fairchild types DTuL 930, 932, 946 and 962, and a gate extender type 933. The universal JK flip-flop is type 945. This family of integrated circuits has been field proven and is widely used in high reliability commercial and military systems and... is available from multiple sources with consistent, repeatable characteristics. Over 67 million component life test hours has indicated a failure rate of .0008%/1000 hours when operated under severe environmental conditions.

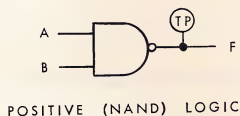
FLIP-FLOP LOGIC - The basic flip-flop card is a dual rank JK element. Generous internal gating is provided to form counters and shift registers without the need for external elements. Inputs include clocked set and clear, clock input and DC set and clear. There are no capacitive or delay elements within the flip-flop to decrease noise protection. The logic used is NAND (AND-INVERT) with active state (Logical "1") positive. With the clock input low, the synchronous inputs may be varied with no effect. The master flip-flop stores the information when the clock voltage is high and transfers it to the slave when the clock voltage is low. DC (asynchronous) set and clear inputs are provided which override the synchronous inputs for preset applications. JK cross connections of output to input are left to the user to permit this element to be used as an RS flip-flop with auxiliary input gating.

NAND GATE LOGIC - The basic positive NAND gate will perform all required logical functions. Inputs are expandable up to 20 by the addition of diode clusters to the gate extender node. Symbol indicates the AND function, and the inverting property is portrayed by the change of active (Logical "1") signal level from input to output. For all of the element symbols, a small circle at an input or output terminal signifies that the active level is the less positive of the two logic voltages. If the circle is omitted, the active level is the more positive of the two voltages. The negative-logic form is the NOR function. The shape of the symbol indicates the OR function, and... as in the case of the NAND function, inversion is indicated by a change of active signal level from input to output, but in the opposite sense.

The outputs of the flip-flops and basic gates, except the 4 LDN-6 buffers, may be connected in parallel to produce the "AND-OR-INVERT" (wired-OR) function. Individually, the gates in the Wired OR are NAND Gates for positive logic. If one of two such gates has inputs A and B, and the other has inputs C and D, their outputs are $\overline{A \cdot B}$ and $\overline{C \cdot D}$, respectively. When wired together the composite output is $\overline{A \cdot B + C \cdot D}$.

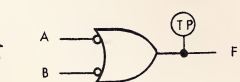


$$F = \overline{A \cdot B}$$



POSITIVE (NAND) LOGIC

$$F = \overline{A + B}$$



NEGATIVE (NOR) LOGIC

SPECIFICATIONS

M/C cards are available in two temperature ranges, 0°C to +70°C for ground systems and -55°C to +125°C for airborne or military applications. To order a full temperature range card add suffix "A" to model number.

Propagation delays, fanouts, current requirements and input loading specified in the chart on the back cover apply to either 0°C to +70°C or full temperature range cards. Numbers indicated on the reverse cover chart are for "worse case" stack up of conditions.

Power dissipation / speed / capacitive loading / fanout / tradeoffs to achieve higher performance than indicated by the chart are simple and convenient by referring to additional data available on request. All devices used are completely defined under the above tradeoff conditions by data presented in tabular and graphical form from the semiconductor manufacturer.

All cards operate from a single 5.4 V power supply. Power connection to all boards is provided to pin 18. Ground connection to all boards is provided to pin V. Multiple outputs and auxiliary grounds are provided on many cards for system convenience.

Noise Immunity - Typical 0°C to +70°C noise immunity is 1.5 V "worse case" (ground line or low input level) 0°C to +70°C noise immunity is 800 mv. Gates will not trigger on power supply perturbations of ± 2 V from nominal. "Worse case" (ground line or low input) -55°C to +125°C noise immunity is 350 mv.

All semiconductors are silicon planar epitaxial for high reliability.

Resistors are metal film. Electrolytic Capacitors are solid tantalum.

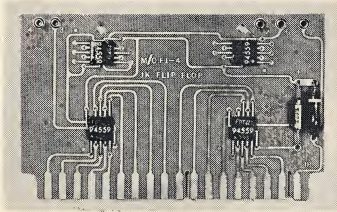
All cards include power supply filtering.

MECHANICAL FEATURES

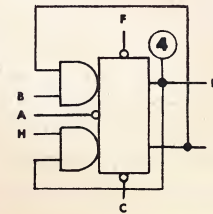
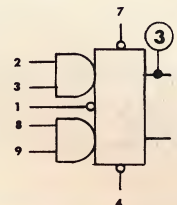
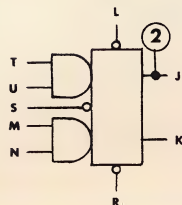
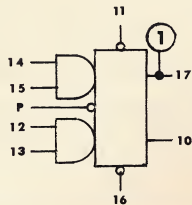
All cards of the Integrated Circuit Series are 2" x 3 1/4" and are designed for .393" card to card spacing unless otherwise specified. Cards feature top side testpoints on grounds and outputs of all elements to facilitate system checkout and maintenance. Automated fabrication and assembly techniques are used to insure product uniformity. Boards are manufactured from two-sided 1/16" thick epoxy glass per MIL-P-13949C type GF, color - tan with plated through holes, and are gold plated (80 to 100 millionths) to improve solderability and prevent tarnishing. Components are wave soldered for ease of replacement. All components are mounted to one side of the circuit card to prevent handling damage and facilitate assembly and repair. Final assembly is coated with a clear acrylic conformal coating for humidity, sand and dust protection. Complete packaging hardware is available for mounting up to 160 cards in a 3 1/2" x 19" wide rack space.

BASIC BUILDING

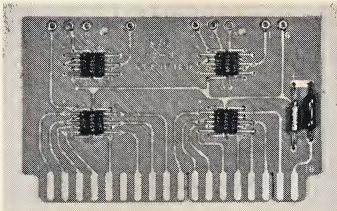
F1-4 Universal Flip-Flop



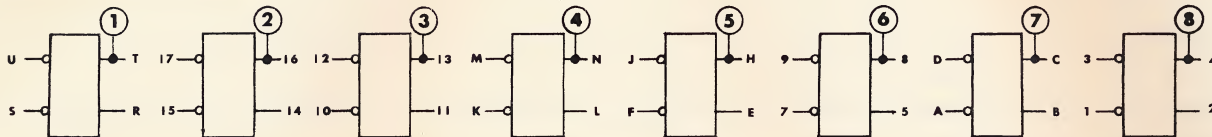
F1-4 Universal Flip-Flop Card contains 4 independent circuits per card, each with separate synchronous inputs and asynchronous DC inputs. Each flat-pack module on the F1-4 card consists of two flip-flops connected as a "master-slave" combination. The master flip-flop stores the information when the clock voltage is high and transfers it to the slave when the clock voltage is low. Direct (asynchronous) set and clear inputs are also provided to permit arbitrary, preset, counting and shifting applications. The universal flip-flop card can be used in shift registers, up-down counters, parallel transfer and other functions normally encountered in flip-flop applications. Polarizing key positions of the F1-4 card are 1 and 8.



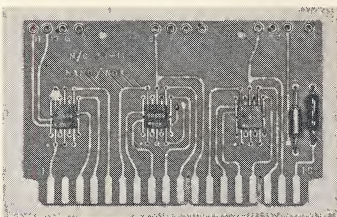
F2-8 RS Flip-Flop



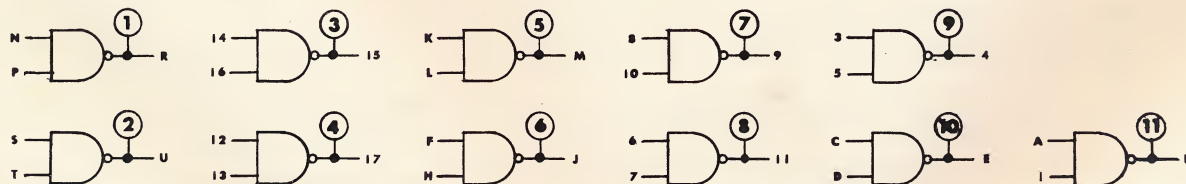
F2-8 Basic Flip-Flop Card contains 8 flip-flop circuits and is constructed of 2 standard two-input gates by cross-coupling each output back to one of the dual gate. This card provides a simple and economical means of constructing a system requiring a large number of storage elements, and minimizes back plane wiring requirements. The F2-8 is useful for control operations, input-output registers, switch contact bounce elimination and storage buffer applications. Polarizing key positions of the F2-8 Card are 2 and 8.



2N-11 NAND/NOR Gate



2N-11 NAND/NOR Gate contains 11 two-input NAND (AND-INVERT) logic gates. It is the basic logic element in the M/C DTL integrated circuit line. In addition to performing the positive NAND and Negative NOR logic operations, the dual gate can be cross-coupled to form a flip-flop or outputs can be connected in parallel to form the "AND-OR-INVERT" function. The logic gating section of a computer or data handling system may be economically generated from the DTL family with a flexible choice of two, three and four term gates, gate extenders and line driver buffers. Polarizing key positions of the 2N-11 Card are 3 and 8.

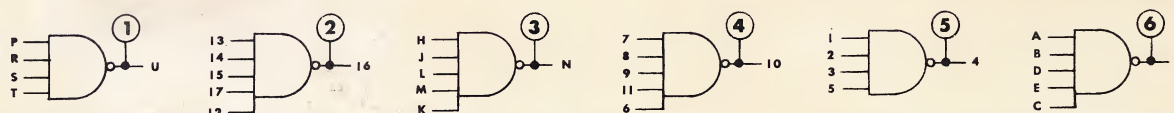


3N-8 NAND/NOR Gate

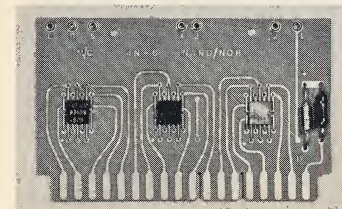
3N-8 NAND/NOR Gate contains 8 three-input NAND gates electrically similar to the 2N-11, but with the added gate term. In addition it contains an inverter element of similar design. Polarizing key positions of the 3N-8 are 3 and 5.

BLOCK ELEMENTS

4 N-6 NAND/NOR Gate Card contains 6 four-input NAND gates, four of the NAND gates are provided with gate extender nodes. Diode clusters using the 4 GE-6 card can be added to this node, allowing fan-ins to be increased to 20. The gate structure, with the exception of the additional inputs, is electrically identical to the other gates in the M/C DTL Integrated Circuit Series. Polarizing key positions of the 4 N-6 Card are 5 and 8.

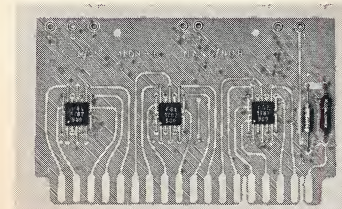


4 N-6 NAND/NOR Gate



4 LDN-6 NAND/NOR Gate Line Driver Card contains 6 four-input NAND/NOR gates. Four of the NAND/NOR gates are provided with gate extender nodes. This card features an output buffer on each gate element for use where high fan-out and/or large capacitive loads must be driven, such as....reset lines, clock lines or output interfaces. A 4 LDN-6 gate provides a low output impedance in both the zero and the one states, permitting 30 ma of sink loading and 200 ohms output impedance for source loads, allowing it to be used directly to drive 5 V interface circuitry. The outputs of the 4 LDN-6 card may not be connected in parallel. Polarizing key positions of the 4 LDN-6 Card are 1 and 5.

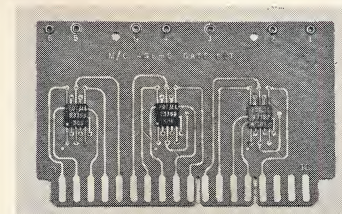
4 LDN-6 NAND/NOR Gate



4 LDN-6 Wiring diagram same as 4 N-6 above.

4 GE-6 Gate Extender Card consists of 6 independent four-input diode arrays that are identical to the input diodes of the DTL gate and buffer elements. 4 GE-6 cards may be used to increase the fan-in of 4 LDN-6 and 4 N-6 logic cards to 20 without adversely affecting noise immunity or load driving ability of the element to which it is connected. Good practice dictates that extension interconnection paths be as short as possible to minimize the effects of distributed capacitance on circuit performance. Typical input capacitance of 4 GE-6 elements is 2 pf and output capacitance is 5 pf. Polarizing key positions of the 4 GE-6 Card are 4 and 8.

4 GE-6 Gate Extender

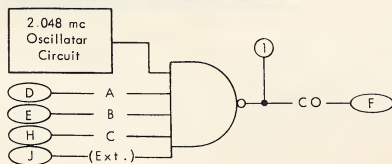
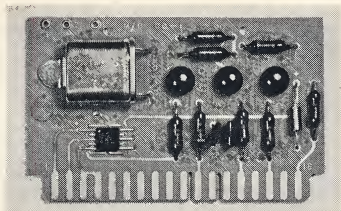


MG-9 Mixed Gate Card contains 4 two-input NAND gates, 3 three-input NAND gates, and 2 four-input NAND gates. This card utilizes gate elements identical to those available on the single type cards, but offers the advantage of achieving higher card utilization in small systems. Polarizing key positions of the MG-9 Card are 1 and 4.

MG-9 Mixed Gate

CLOCK AND TIMING ELEMENTS

CO-1 Crystal Oscillator



CO-1 2.048 mc Crystal Oscillator Card is used in systems requiring a well controlled clock frequency. Other crystal frequencies are available on request. This circuit features a high stability oscillator circuit which achieves low drift over the entire temperature range. The output buffer consists of a four-input gate identical to the 4 LDN-6 card to allow the clock to be gated. An auxiliary four-input power NAND gate is provided on each card to allow up to 40 clock loads to be driven, or it may be used for other functions within the system. Polarizing key positions of the CO-1 Card are 6 and 8.

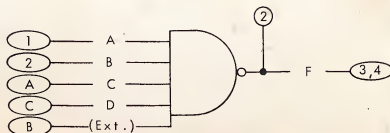
Frequency = 2.048 mc (standard) $\pm 0.02\%$ at 25°C

Drift - 0°C to 70°C $\pm .003\%$
-55°C to +105°C $\pm .005\%$

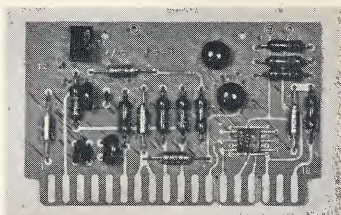
Long Term Stability - $\pm 0.02\%$ (Typ.)

Card Size - 2 x 3.250 x 0.412

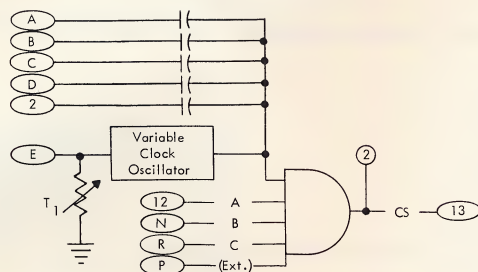
Auxiliary Grounds...K,L,M,N,P,R,S,T,U,11,14,16



CS-1 Clock Source



CS-1 Clock Source provides a flexible range of operating frequencies with adequate stability for most synchronous systems. The range of timing components included on the card eliminates the need for external elements which are inconvenient to mount and have undefined stray losses. A variable resistor is included to allow selection of any frequency between 600 cps and 1 mc. An auxiliary four-input power NAND gate is provided to allow up to 40 clock loads to be driven. Drift - 3% above 2.3 kc (0°C to 70°C); 5% below 2.3 kc (0°C to 70°C). Polarizing key positions of the CS-1 Card are 3 and 6.



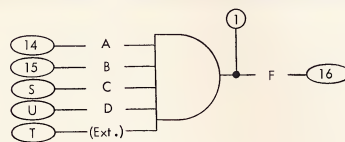
CLOCK FREQUENCY RANGE

600 cps - 2.3 KC
2.3 KC - 10 KC
10 KC - 48 KC
48 KC - 125 KC
125 KC - 220 KC
220 KC - 475 KC
475 KC - 1 mc

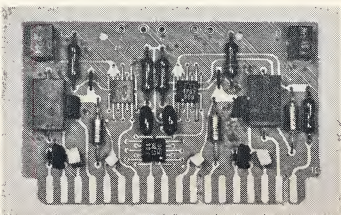
CONNECT PINS

A to E ; D to Ground
B to E ; D to Ground
C to E ; D to Ground
D to E ; 2 and C to Ground
D to E ; 2 to Ground
2 to E
No Connection

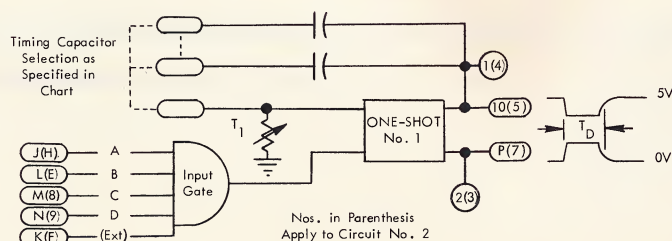
Auxiliary Grounds.....6,7,8,9,10,F,H,J,K,L,M



OS-2 One Shot Multivibrator



OS-2 One-Shot Multivibrator Card contains two independent one-shot circuits, including all necessary components for generating a wide range of delays. Timing elements provided with the card have been selected for high stability consistent with small physical size. The one-shot delay action is initiated when the logical AND is true (+5 V)....and continues for a full cycle back to a reset or stable state, ignoring any additional trigger inputs that may occur during the one-shot cycle....the one-shot can be operated at duty cycles up to 50%. These properties allow the OS-2 card to be used as an approximate synchronized frequency divider in addition to the classical systems uses. Both normally positive and normally zero outputs are provided and each output is identical in drive capability to the 4 LDN-6 Gates. Polarizing key positions of the OS-2 Card are 1 and 7.



DELAY TIME RANGE (T_D)

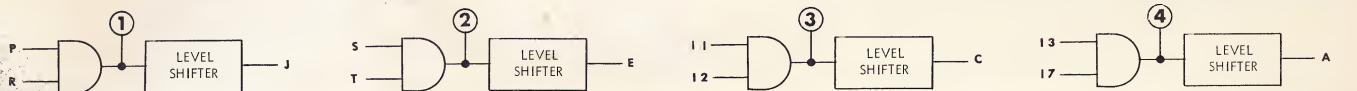
50 - 200 ns
200 - 600 ns
600 - 1300 ns
1.3 - 5 us
5 - 20 us
24 - 80 us
100 - 470 us
.520 - 2 ms
2.3 - 10 ms

CONNECT PINS

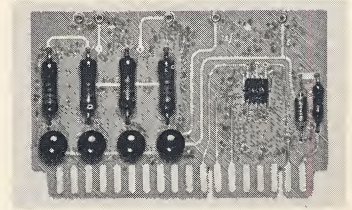
Circuit No. 1 | Circuit No. 2
No Connection....
T to 14 | B to 1
T to R | B to C
T to 15 | B to 2
T to S | B to 4
T to 17 | B to A
T to 12 | B to D
T to 11 | B to 6
T to 16 | B to 3

LOGIC INTERFACES

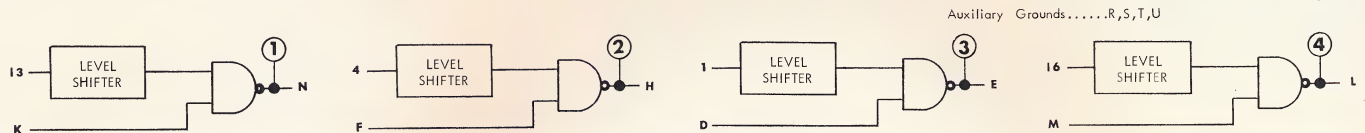
I 1-4 Positive Output Interface Card contains 4 output interface drivers. Each circuit uses a two-input NAND gate to determine the output condition. The circuit is non-inverting. That is, if the positive logical AND of the dual-input gate is true, the output will be true (high). If either A or B is low, the output will be low. The output logical swing is determined by the voltage applied to pin H on each card. The range of permissible output signals is from 0 to 35 V maximum. The output collector resistor is 2.7 K typical propagation delays are 90 ns with 100 pf shunt capacitance and 40 ma sink load at V_{cc} (Ext.) -24 V. Polarizing key positions of the I 1-4 Card are 2 and 7.



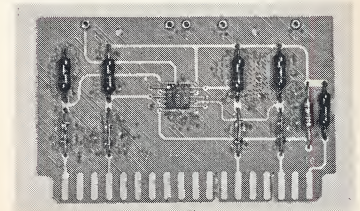
I 1-4 Positive Output



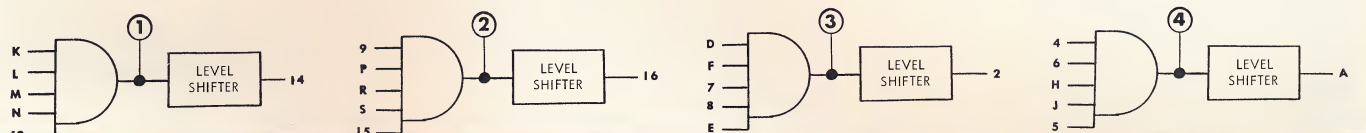
I 2-4 Positive Input Interface Card contains 4 input interface circuits. This card is useful as a level changer to allow positive logic swings up to 50 V to be converted to voltages compatible with the integrated circuit levels. A two-input NAND gate is used as the output for compatibility with the integrated circuit loads. An auxiliary input to the NAND gate is provided to allow input signals to be gated into the logic system for applications as a digital multiplexer. The outputs of the I 2-4 card can be wired in parallel to perform the "wired OR" function. The circuit is inverting relative to the input signal. Polarizing key positions of the I 2-4 Card are 3 and 7.



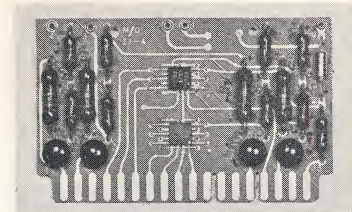
I 2-4 Positive Input



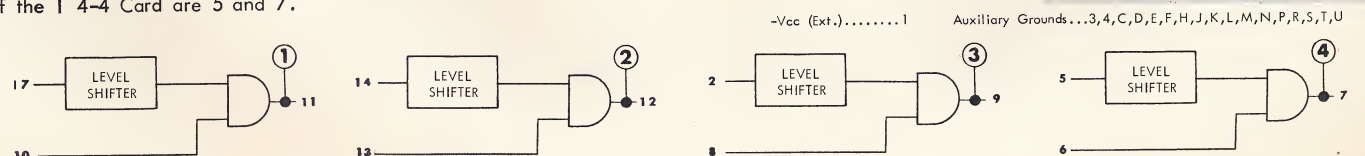
I 3-4 Negative Output Interface Card contains 4 independent output interface circuits. This card is offered in two output interface levels. For output logic swings from 0 to -14 V, specify I 3-4. For output logic swings from -14 V to -24 V, specify L I 3-4. Generous input gating is provided to increase the utility of this interface circuit. This circuit is non-inverting in a logical sense. The basic I 3-4 and L I 3-4 Cards are designed for non-polar (0 to -V) negative output logic swings. Modifications of this card are available for bi-polar logic swings upon request. The required negative logic voltage swing is determined by the static voltage applied to the -Vcc terminal, pin 1. Polarizing key positions of the I 3-4 Card are 4 and 7.



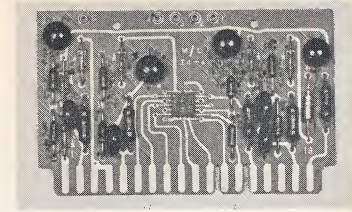
I 3-4 Negative Output



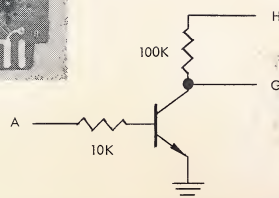
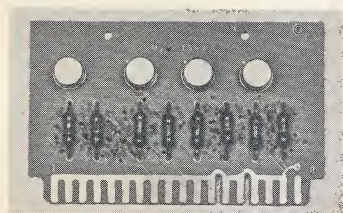
I 4-4 Negative Input Interface Card contains 4 independent circuits per card. The circuit features input impedance of 10 K. A negative voltage equal to the logic swing is applied to the -Vcc (Ext.) pin for converting logic input levels to integrated circuit voltages. Diodes are included on the card to increase the threshold voltage for noise rejection. Additional noise rejection can be achieved by adding external diodes or a clamp voltage to the -Vcc (Ext.) pin if desired. Maximum negative input levels are -35 V. Polarizing key positions of the I 4-4 Card are 5 and 7.



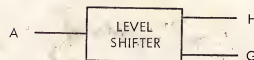
I 4-4 Negative Input



15-4 Neon/NIXIE Driver



FUNCTIONAL DIAGRAM



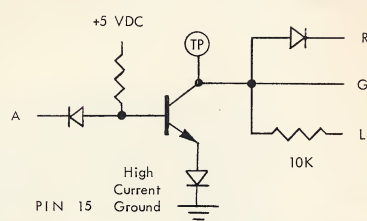
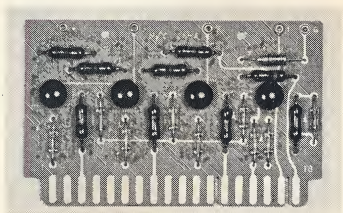
LOGIC SYMBOL

Ckt.# Fctn.	I 1	I 2	I 3	I 4
A	B	H	M	S
G	C	J	P	T
H	D	K	N	U

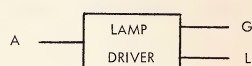
Signal Ground.....V +5 Volts D C.....18

Auxiliary Grounds.....1 through 17

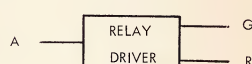
16-4 Relay/Lamp Driver



FUNCTIONAL DIAGRAM



LOGIC SYMBOL
LAMPS



LOGIC SYMBOL
RELAYS

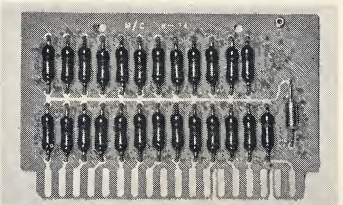
Ckt. # Fctn.	I 1	I 2	I 3	I 4
A	T	M	F	A
G	17	N	H	B
R	D	D	D	D
L	P	13	8	3

Signal Ground.....V

Auxiliary Ground.....R.S.U.

+5 Volts D C..... 18

R-24 External Load



R-24 External Load Card is provided as a convenient means of reducing the recovery time of Flip-Flops and the logic gates when driving large capacitive loads at high repetition rates. When using the external load resistor reduce fan-out by one load. Resistors used on the R-24 card and all other DTL Integrated Circuit Series Cards are high stability, long life metal film.

SYSTEM FUNCTIONAL BLOCKS

In many systems it is desirable to use cards that perform complete common functions to minimize back plane wiring and design time. M/C provides a basic set of such functional cards and encourages customer requests for addition to this list. Functional cards utilize combinations of basic elements that are completely specified within the detail element descriptions. Available system functional blocks are:

- | | | | |
|--------|--------------------------------------|---------|---|
| DC-1 | BCD DECADE COUNTER | BDD-1 | BCD TO 10 LINE DECIMAL DECODER/DRIVER |
| DC-2 | BCD DUAL DECADE COUNTER | 4 PBC-1 | 4 BIT PARALLEL CARRY SYNCHRONOUS BINARY COUNTER |
| RDC-1 | BCD REVERSIBLE DECADE COUNTER | 4 BC-2 | DUAL 4 BIT BINARY COUNTER |
| 4 SR-2 | PRESETABLE DUAL 4 BIT SHIFT REGISTER | | |

Write or call your local representative for information on additional functional elements.

ANALOG ELEMENTS

Consistent with MICROSYSTEMS COMPONENTS policy of total systems capability, M/C offers a range of commonly used analog systems elements designed to interface with the DTL Integrated Circuit Series Logic Cards. Many of these cards feature the use of analog and digital integrated circuits.

LD-(V) PRECISION LEVEL DETECTOR - This analog building block element is available for signal presence indication and applications as a schmitt trigger or limit detection device. It features detection stability limits of ± 5 mv (0°C to 70°C) including all sources of error. Detection level limits are available in 1 V increments from 0 to 5 V. The output of the level detector card is capable of driving $+28$ V, 100 ma relays as well as logic circuits. Two level detector cards may be interconnected to form a double limit detection system in which the output is true only when the input is between the two individually preset levels. The required "EXCLUSIVE OR" circuitry is included on the card.

OA-1 OPERATIONAL AMPLIFIER - This amplifier is designed for high gain and DC stability and provides compatibility with the other analog system elements manufactured by M/C....

Open loop gain..... 2×10^4 minimum

Gain crossover..... 10 mc

DC stability (x 1 amplifier).... 10 mv ("worse case")

Output Current 10 ma

Output Voltage swing..... ± 15 V

A/D CONVERTOR - This system consists of two analog cards with separate reference supply and logic cards wired per furnished schematic. Typical specifications are:

Accuracy..... 1/2% Conversion Rate..... 8,000 per second

Resolution..... 8 bits Input Level zero to ± 5 VDC

RPS-15 REFERENCE POWER SOURCE - This card provides a high stability DC reference voltage for use in D/A and A/D Convertors and other analog systems.

Output impedance.. less than one ohm Power source..... ± 28 V

Stability (long term)..... .05% Output current.. 0 to 20 ma

Temp. stability (0 to 70°C).... 0.25% Output voltage.... ± 15 V

D/A CONVERTOR (4 Bit Binary) - This card accepts four line binary input data and stores the command signals in individual registers. The output of each register in turn drives the D/A convertor solid-state switches that determine the analog output. The composite outputs are then coupled to the OA-1 operational amplifier for accumulation. All registers are parallel updated and cleared by a common clock line signal. Maximum updating rate..... 100 KC.

MULTIPLEXER SWITCHES - Multiplexer switches are available in a variety of forms depending on individual system requirements.

LOW LEVEL (below 20 mv) switches use MOS-FET devices and provide extremely low offset voltages and operate well into and from high impedance sources.

MEDIUM LEVEL (20 to 250 mv) use dual emitter integrated choppers for faster switching speeds.

HIGH LEVEL/HIGH SPEED switching systems have been implemented largely from planar discrete transistors.

All multiplexing elements are available with or without individual channel storage registers for pulsed or synchronously clocked systems.

CM-1 COMMON-MODE ISOLATOR - This card contains a differential amplifier circuit capable of handling very high level common mode inputs. This low cost card is useful in rescuing differential signals from large common-mode voltages as encountered in power supply shunts and analog comparitors requiring large signal swings. The Common-Mode rejection ratio is 70 db (large signal) and differential conversion gain stability is 0.25%.

DC to 400 cps CONVERTORS - Switching type DC/AC Convertors provide stable conversions to accuracies of .5% worse case. Spurious harmonics are down 50 db below the center frequency output. The output is filtered to produce clean 400 cps output. All components are mounted on a single M/C standard sized card. Height of components (.700") requires two card slots. Input impedance is 100,000 ohms. Output impedance is 10 ohms.

POWER SUPPLIES

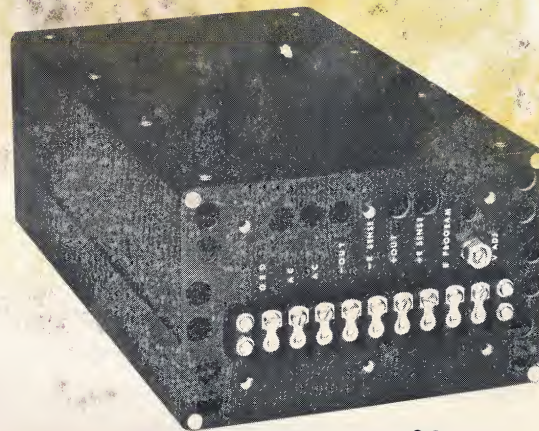
Power Supplies offered by M/C include specific features for integrated circuit systems applications. This includes, short circuit protection, over-voltage protection, and negative voltage protection to prohibit power turn-on or load induced transients from causing circuit failure. These safety precautions are necessary to avoid mass failure of logic elements that occur if the power supply voltage becomes negative. Outputs of all power supplies are "crow-barred" at 8 V maximum to protect the integrated circuits in the event of internal power supply failure.

Power supplies are designed to perform under all load conditions in ambient temperature ranges from -20°C to 70°C without external cooling. Input supply requirements are 105 to 125 Vac, 50 to 400 cps. Adjustments are included in each power supply to provide .25 V variation around the 5.4 V nominal power supply output. Once adjusted, the power supplies are designed for continuous operation without adjustment or attention for a minimum of three months.

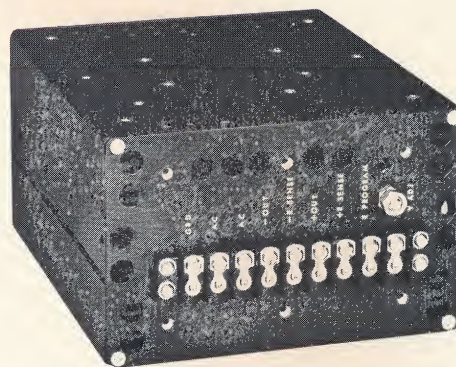
CARD MOUNTED POWER SUPPLIES

CMP-5.4 is a card mounted 5.4 V logic power supply designed to supply low current needs for special test equipment and breadboards. The same features are included as in our modular power supplies. The CMP-5.4 is mounted on two M/C standard size plug-in cards. This power supply furnishes up to 500 ma of well regulated output current for operating approximately 15 average logic cards.

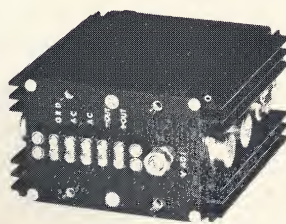
CMP-140 is a card mounted neon or NIXIE indicator power supply built to occupy two M/C standard card slots. This power supply furnishes 15ma at 140 V suitable for driving up to ten neon or NIXIE indicators.



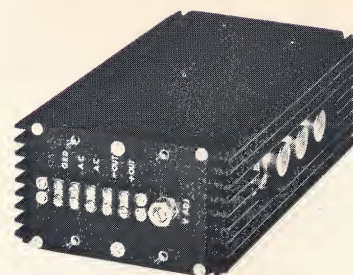
P 20



P 10



P 2



P 5

MODULAR POWER SUPPLIES

Model No.	Current	Length	Width	Height	End Insert Mounting Pattern	Bottom Insert Mounting Pattern	
P-2	2 amp	5.50	4.875	2.80	4 #6-32 Inserts Each End	4 #6-32 Mounting	3 wide x 2.5
P-5	5 amp	9.25	4.875	2.80	2.375 x 2.218 (Sym.)	Inserts On Bottom	3 wide x 3.25
P-10	10 amp	9.00	8.00	5.00	6 #10-32 Inserts Each End	6 #10-32 Mounting	5.25 wide x 3.375 x 3.375
P-20	20 amp	13.50	8.00	5.00	5.25 x 3.25 (Sym.)	Inserts On Bottom	5.25 wide x 6 x 6

ACCESSORIES

Low cost peripheral equipment is available which features flexibility, convenience and significant size reduction compared to conventional logic cards.

The positive clamping action of large area bellows contacts eliminates the need for card cages or bulky card retention devices for most ground systems applications using the low profile, light-weight M/C logic cards.

CARD FILES AND DRAWER

MP-1 - 40 Cards in 16.66" to fit inside the M/C CH-1 3 1/2" dwr.

MP-2 - 20 Cards in 8.80" for S T E and breadboards

MP-3 - 44 Cards in 19" for rack or bay mounting

CH-1 - Basic Drawer

CH-1S - Drawer assembled with 4 MP-1 Panels for 160 cards

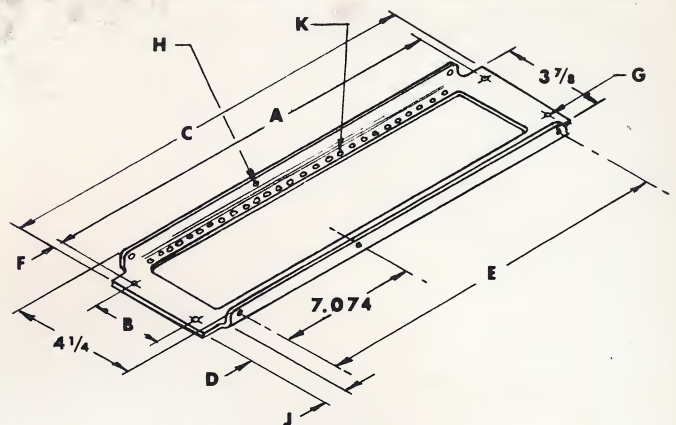
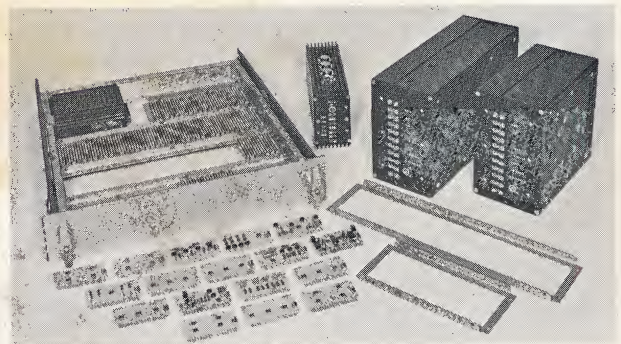
OTHER ACCESSORIES

BC-1 Kluge Card with predrilled holes for connector pins and etch patterns for assembling one flat-pack IC, four transistors and 50 assorted components. Polarizing key positions are 2 and 5.

BC-2 Blank Card with connector pattern only. Polarizing key positions are 2 and 4.

EX-1 Extender Card with point to point connector wiring.

Laminated planar power busses for MP series card files.



Model#	A	B	C	D	E	F	G	H	J	K
MP1	16.312	3.00	16.66	.86	14.934	.18	.172 Dia 4 Holes	.177 Dia 6 Holes	.44	.128 Dia 80 Holes
MP2	8.452	3.00	8.00	.86	7.074	.18	.177 Dia 4 Holes	.177 Dia 4 Holes	.44	.128 Dia 40 Holes
MP3	18.250	1.75	19.00	1.28	16.506	.38	1/4 Slot 4 Plcs.	.177 Dia 6 Holes	.75	.128 Dia 88 Holes

CONNECTORS

M/C connectors feature a proven bifurcated bellows spring contact in a variety of rear contacts and mounting styles. All contacts are gold plated to insure good contact and prevent tarnishing. The molded insulators on all M/C panel connectors are slotted to permit the use of polarizing keys. Connector pins are identified by molded-in alpha-numeric symbols to simplify wiring and assembly. Connector material is military approved Diallyl Phthalate (MIL-M-19833), or economical glass filled Alkyd. Connectors are furnished with 2 keys.

Connector Termination Styles

C 1 - Pierced for general solder connections

C 2 - Dip Solder for "mother boards"

C 3 - Notched for bare bus applications

C 4A - Wire Wrap, Diallyl Phthalate only

C 5A - Taper Pin, Diallyl Phthalate only (requires 2 card slots/cd)

Standard connectors supplied with clearance holes for #4-40 screws.

C-1, 2, 3 are available with 4-40 tapped inserts by adding suffix "T".

C-1, 2, 3 are commercial, glass filled, Alkyd; for military approved Diallyl Phthalate, add suffix "A".

DTL INTEGRATED CIRCUITS DESIGN KIT

K 1 design kit provides useful circuits for special test equipment or simple digital systems and is a convenient source of short-run bread-board parts which can easily be reused in many development projects without soldering or damage to the card.

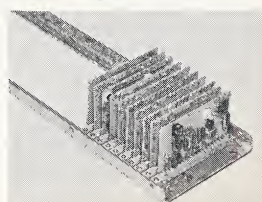
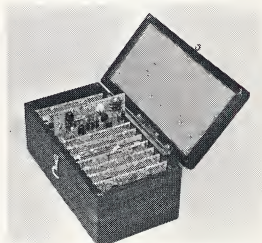
Companies using M/C Kits have saved thousands of dollars in bread-boarding cost and hundreds of hours of engineering time by utilizing our convenient integrated circuit logic cards.

THIS KIT INCLUDES:

MOD.NO.	DESCRIPTION	QUANTITY
F1-4	4 J-K Flip Flops	3
2N-11	11 two-input NAND/NOR gates	2
4N-6	6 four-input NAND/NOR gates	1
4GE-6	6 four-input gate extenders	1
4LDN-6	6 four-input NAND/NOR line drivers	2
CS-1	Variable clock source including all timing components for generating clock frequencies from 600 cps to 1 mc	1
OS-2	2 variable one-shots including all timing components for generating delays from 180 ns to 10 ms	1
16-4	4 high speed Logic/Relay/Lamp drivers (35V, 100ma, 40 ns)	1
C-1	Connectors	18
MP-2	Mounting Tray	1

TOTAL

PLUS: Walnut storage container (shown in photo) and 5 sets of individual data sheets and application notes.



MODEL	DESCRIPTION	INPUT LOADING ①	FAN-OUT ① ②	CAPACITIVE LOAD	DELAY PER MODULE ③	CURRENT PER CARD
F1-4	4 J-K flip-flops Clock Input Enable input Asynchronous input	2 2/3 1	8	40 pf	60 ns	28 ma
F2-8	8 R-S flip-flops	1	8	40 pf	60 ns	28 ma
2N-11	11 2-input NAND/NOR	1	8	40 pf	40 ns	21 ma
4N-6	6 4-input NAND/NOR with gate extenders ④	1	8	40 pf	40 ns	42 ma
4GE-6	6 4-input gate extenders	1	1			0
4LDN-6	6 4-input NAND/NOR line driver or buffer with gate extension capability	1	20	400 pf	35 ns	42 ma
CO-1*	Crystal oscillator 2.048 mc		20	400 pf		50 ma
CS-1	Clock source (variable frequency)		20	400 pf		42 ma
OS-2	2 one-shot multivibrators		20	400 pf		35 ma
I1-4	4 interfaces (I to +)	1		100 pf	90 ns	
I2-4	4 interfaces (+ to I)		8	400 pf	55 ns	12 ma
I3-4	4 interfaces (I to -)	1		100 pf	150 ns	28 ma
I4-4	4 interfaces (- to I)		8	400 pf	70 ns	20 ma
I5-4	4 neon/nixie drivers	1/2				
I6-4	4 relay/drivers	1				

1. A unit load is the load of one NAND/NOR gate.
2. Input loads and stray capacitance are combined.
3. This is the maximum value of 1/2 (turn on delay + turn off delay) over the full temperature range with capacitance and DC load.
4. Outputs of 2N-11 and 4N-6 may be connected for the "wired OR" function $(\overline{ABCD} \bullet \overline{GHIJ} = \overline{ABCD + GHIJ})$.

5. These rules apply over the entire military temperature range with a supply voltage of 5.10 to 5.60 volts. These rules also permit a 50°C temperature differential between individual elements.
6. These rules guarantee a worst case signal-line or ground noise threshold of at least 350 mv. 0 to 70°C noise thresholds exceed IV.

MICROSYSTEMS COMPONENTS

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Woodland Hills, Calif., 213-346-1161